What is claimed is:

1. A screwed steel pile, the main body of which is composed of a hollow pipe, a pile end of the main pile body being open or closed by a bottom plate arranged on the entire face of the pile end portion, one or a plurality of wings being arranged on the outside of the pile end portion of the main pile body, and a pile end portion of the wing protruding downward from a face of the forward end of the main pile body.

2. A screwed steel pile according to claim 1, wherein the pile end portion of the wing is extended in the radial direction so that it can protrude from an inside face of the main pile body.

3. A screwed steel pile according to claim 1 or 2, wherein the wing is made of an abrasion resistance steel plate or a low friction steel plate.

4. A screwed steel pile according to one of claims 1 to 3, wherein a excavating blade is attached to a pile end portion of the wing.

5. A screwed steel pile according to one of claims 1 to 4, wherein the width of the wing is changed in the circumferential direction so that the width can be extended when it is directed upward from the pile end portion.

6. A screwed steel pile according to one of claims 1 to 5, wherein the thickness of the wing is changed in the radial direction so that the thickness can be reduced when it is separated from the outside of the main pile body.

7. A screwed steel pile according to one of claims 1 to 6, wherein an end portion of the main pile body located downward with respect to the wing is cut off along the wing.

8. A screwed steel pile, the main body of which is composed of a hollow pipe, a pile end of the main pile body being open, one or a plurality of wings being arranged on the outside of the pile end portion of the

main pile body or on the pile end face of the main pile body, and a portion on the inner circumferential side of the wing arranged on the pile end face protruding from the inside of the main pile body.

9. A screwed steel pile, the pile end portion of the main pile body of which is provided with a bottom plate ring so that the screwed steel pile is formed into an open end pile, or the pile end portion of the main pile body of which is provided with a bottom plate so that the screwed steel pile is formed into a closed end pile, one or a plurality of wings being arranged on the outside of the lower end portion of the pile, the lower end portion of the wing being protruded downward with respect to the bottom plate ring or the bottom plate, and the protruding portion being extended in the radial direction of the pile so that the protruding portion can reach the bottom plate ring or a portion of the bottom plate or the entire bottom plate, wherein the extending portion and the protruding portion are formed into a excavating blade.

10. A screwed steel pile according to claim 9, wherein the inside face of the bottom plate ring is protruded from the inside of the main pile body, and an earth and sand blocking effect generating ring is provided on the inside face of the main pile body in an upper portion of the bottom plate ring.

11. A method of construction management for managing the construction of a screwed steel pile having one or a plurality of wings on the outside of the lower end portion of the pile, comprising the steps of: finding penetrative resistance in the process of construction; and controlling to continue and/or complete penetration of the screwed steel pile according to the penetrative resistance while the penetrative resistance is being found.

12. A method of construction management for managing the construction of a screwed steel pile

according to claim 11, wherein penetrative resistance Rp is found by the following equation.

$$Rp = \{(\cos\theta - \alpha\sin\theta)(Ht - Qwh) + (\sin\theta + \alpha\cos\theta)Lb\} / \{(1 + \gamma)(\sin\theta + \alpha\cos\theta) + \alpha(Dp'/Dw')(\cos\theta - \alpha\sin\theta)\}$$

θ: Angle of a wing with respect to a face perpendicular to a pile axis

α: Coefficient of friction between a ground and a steel plate

Ht: Value obtained when torque acting on a pile end is converted into a horizontal force on an action circle

Lb: Upper load acting on a pile end

Dp': Diameter of an action circle of a bottom plate

Dw': Diameter of an action circle of a wing

Qwh: Horizontal resistance of a ground received by a blade end

γ: Coefficient of resistance of a perpendicular blade end

Rp: Resistance of penetration of a ground received by a bottom plate portion which is a projected area portion of a bottom plate ring or a bottom plate

13. A method of construction management for managing the construction of a screwed steel pile according to claim 12, wherein bearing capacity Qu of a pile end is estimated by the following equation.

$$Qu = (Rp/d) \times \{1 + e(Aw/Ap)\}$$

where Aw is a projected area of a wing, Ap is a projected area of a bottom plate portion, e ($0 < e \leq 1$) is an effective working ratio of a wing portion, d is a coefficient of correction determined by a quantity of penetration at the time when drilling of a pile is stopped, and Qu is a bearing capacity of a pile end.

14. A method of construction management for managing the construction of a screwed steel pile according to claim 12, wherein a pulling capacity Qup of

a pile end with respect to pulling is estimated by the following expression.

$$Qup \geq Rp - Lb$$

where Qup is a pulling capacity of a pile end with respect to pulling.

15. A method of construction management for managing the construction of a screwed steel pile having one or a plurality of wings on the outside of the lower end portion of the pile, comprising the steps of: finding penetrative resistance Rp by the following equation in the process of construction; and controlling to continue and/or complete penetration of the screwed displacing pile according to the penetrative resistance while the penetrative resistance is being found.

$$Rp = [2\pi Tb + Lb\{(1 - c)S + cP + \alpha\pi Dw'\} - QwhπDw' - QwvS]/\{(1 - c)S + cP + \alpha\pi(Dp' + Dw')\}$$

α: Coefficient of friction between a ground and a steel plate

Tb: Torque acting on a pile end

Lb: Upper load acting on a pile end

P: Wing pitch

S: Quantity of penetration per one revolution

Dp': Diameter of an action circle of a bottom plate or a bottom plate portion

Dw': Diameter of an action circle of a wing

Qwh: Horizontal resistance of a ground received by a blade end

Qwv: Vertical resistance of a ground received by a blade end

c: Coefficient of consumed energy by a ground caused by forced deformation of a wing directed upward

Rp: Resistance of penetration of a ground received by a bottom plate or a bottom plate portion which is a projected area portion of the bottom plate

16. A method of construction management for managing the construction of a screwed steel pile

according to claim 15, wherein bearing capacity Qu of a pile end is estimated by the following equation.

$$Qu = (Rp/d) \times \{1 + e(Aw/Ap)\}$$

where Aw is a projected area of a wing, Ap is a projected area of a bottom plate or a bottom plate portion, d is a coefficient of correction determined by a quantity of penetration at the time when the drilling of a pile is stopped, e ($0 < e \leq 1$) is an effective working ratio of a wing, and Qu is a bearing capacity of a pile end.

17. A method of construction management for managing the construction of a screwed steel pile according to claim 15, wherein a pulling capacity Qup of a pile end with respect to pulling is estimated by the following expression.

$$Qup \geq Rp - Lb$$

where Qup is a pulling capacity of a pile end with respect to pulling.

18. A method of construction of a screwed steel pile comprising the steps of: rotating a screwed steel pile having a wing at the pile end portion so as to penetrate the screwed steel pile into the ground; reversing the screwed steel pile so as to draw it by an appropriate distance when a quantity of penetration of the screwed steel pile is remarkably decreased; and rotating the screwed steel pile again so as to penetrate it into the ground.

19. A method of construction of a screwed steel pile comprising the steps of: rotating a screwed steel pile having a wing at the pile end portion so as to penetrate the screwed steel pile into the ground; reversing the screwed steel pile so as to draw it by a distance at least not less than a pitch of the wing when a quantity of penetration of the screwed steel pile is remarkably decreased; and rotating the screwed steel pile again so as to penetrate it into the ground under the condition that a pile head is given a load directed

downward.

20. A method of construction of a screwed steel pile, in which the inside-drilling method is also used, comprising the steps of: drilling, rotating and penetrating the screwed steel pile on a soft stratum of a ground and discharging drilled soil and sand to a periphery of the pile so that the drilled soil and sand cannot enter the pile; and conducting inside-drilling on a hard intermediate stratum or a bearing stratum so that the drilled soil and sand can enter the pile.

21. A method of construction of a screwed steel pile according to claim 20, wherein drilled soil and sand are made to enter the screwed pile by the inside-drilling method when the screwed pile is penetrated into a bearing stratum, and solidification material such as cement mortar or cement milk is jetted out from an end of the auger so that the jetted solidification material is solidified and integrated with the forward end portion of the screwed pile, and the screwed pile is supported by and fixed to the bearing stratum of the ground.

22. A method of construction of a screwed steel pile comprising the steps of: inserting an auger used for inside-drilling having a spiral wing of an appropriate length into the screwed steel pile, the end of which is open, having a drilling wing outside of the pile end of the screwed steel pile body, from the lower side, the rotation of the auger being controlled separately from the rotation of the pile; drilling, rotating and penetrating the pile into a soft stratum of the ground so as to drill soil and sand by the drilling wing and forcibly discharge the drilled soil and sand to the periphery of the pile body, the rotation of the auger being stopped during penetrating the pile so that soil and sand cannot enter the pile; and drilling and rotating the auger on a hard stratum of the ground such as an intermediate stratum and a bearing stratum of the ground so that the drilled soil and sand can enter the pile.

23. A method of construction of a screwed steel pile comprising the steps of: using a screwed steel pile, the end portion of which is open or closed, having a wing for drilling a ground, arranged outside in a lower portion of the pile, also using an auger having a spiral wing for drilling of an appropriate length, mounted on an auger shaft inserted into the pile, also using a pipe pile drive section for rotating the pile, and also using an auger drive section for rotating the auger in the normal and the reverse direction; drilling, rotating and penetrating the pile into a soft stratum of the ground so as to drill soil and sand by the wing and forcibly discharge the drilled soil and sand to the periphery of the pile body, the rotation of the auger being stopped during penetrating the pile so that soil and sand cannot enter the pile; drilling and rotating the auger on a hard stratum of the ground such as an intermediate stratum and a bearing stratum of the ground so that the drilled soil and sand can enter the pile; and drawing out the auger from the pile after the completion of penetration of the pipe pile.